

### Claims

1. An electrosterically stabilized aqueous polyurethane resin having an improved profile of properties, obtainable by

a) preparing a hydrophilic and solvent-free macromonomer (A)(ii) with monomodal molecular mass distribution, wherein

a<sub>1</sub>) 50 to 100 parts by weight of a hydrophilic alkyl- and/or arylpolyalkylene glycol (A)(i) having a primary and/or secondary and/or tertiary hydroxyl group which is reactive toward isocyanate groups and having a molecular mass of 250 to 5000 daltons are reacted with 1 to 100 parts by weight of a polyisocyanate (B)(i), consisting of at least one diisocyanate, polyisocyanate, polyisocyanate derivative or polyisocyanate homolog having two or more (cyclo)aliphatic or aromatic isocyanate groups of identical or different reactivity, optionally in the presence of a catalyst,

a<sub>2</sub>) the preadduct from stage a<sub>1</sub>) is reacted completely with 0.5 to 200 parts by weight of a compound (C) having two or more primary and/or secondary amino groups and/or hydroxyl groups which are reactive toward isocyanate groups and having a molecular mass of 50 to 500 daltons, and also

b) by preparing the polyurethane dispersion, wherein

b<sub>1</sub>) 2 to 50 parts by weight of the hydrophilic and solvent-free macromonomer (A)(ii) with monomodal molecular mass distribution, having two or more hydroxyl groups which are reactive toward isocyanate groups and having a molecular

mass of 500 to 5500 daltons, are reacted with 25 to 250 parts by weight of a polyisocyanate component (B)(ii) consisting of at least one polyisocyanate, polyisocyanate derivative or polyisocyanate homolog having two or more (cyclo)aliphatic or aromatic isocyanate groups, optionally with the addition of 0 to 50 parts by weight of a solvent component (D) and optionally in the presence of a catalyst,

b<sub>2</sub>) the polyurethane preadduct from stage b<sub>1</sub>) is reacted with 50 to 100 parts by weight of a polymeric polyol (A)(iii) having two or more hydroxyl groups which are reactive toward isocyanate groups and having a molecular mass of 500 to 5000 daltons

and optionally

with 0.5 to 10 parts by weight of a low molecular mass polyol component (A)(iv) having 2 or more hydroxyl groups and a molecular weight of 50 to 499 daltons, optionally in the presence of a catalyst,

b<sub>3</sub>) the polyurethane preadduct from stage b<sub>2</sub>) is reacted with 2 to 20 parts by weight of a low molecular mass, anionically modifiable polyol component (A)(v) having one, two or more hydroxyl groups which are reactive toward isocyanate groups and having one or more inert carboxylic acid and/or sulfonic acid groups, which by means of bases can be converted fully or partly into carboxylate and/or sulfonate groups, respectively, or are already in the form of carboxylate and/or sulfonate groups, and having a molecular mass of 100 to 1000 daltons, optionally in the presence of a catalyst,

b<sub>4</sub>) the polyurethane prepolymer from stage b<sub>3</sub>), before or during dispersion in water, is admixed, for the purpose of full or partial neutralization of the acid groups, with 2 to 20 parts by weight of a neutralizing component (E),

b<sub>5</sub>) the optionally (partially) neutralized polyurethane prepolymer from stage b<sub>4</sub>) is dispersed in 50 to 1500 parts by weight of water, which optionally further contains 0 to 100 parts by weight of a formulating component (F), and finally

b<sub>6</sub>) the (partially) neutralized polyurethane prepolymer dispersion from stage b<sub>5</sub>) is reacted with 3 to 60 parts by weight of a chain extender component (G) and also, subsequently or simultaneously, with 0 to 30 parts by weight of a chain stopper component (H).

2. The polyurethane dispersion of claim 1, characterized in that component (A)(i) consists of copolymers and/or random copolymers and/or block copolymers, composed of 90% to 10% by weight of ethylene oxide and 10% to 90% by weight of further alkylene oxides having 4 to 30 carbon atoms per alkylene oxide with a primary and/or secondary and/or tertiary hydroxyl group.

3. The polyurethane dispersion of claim 1 or 2, characterized in that component (A)(i) consists of a monofunctional alkylpoly(ethylene oxide-co/ran-alkylene oxide) and/or alkylpoly(ethylene oxide-block-alkylene oxide) and/or sodium sulfonatopropylpoly(ethylene oxide-co/ran-alkylene oxide) and/or sodium sulfonatopropylpoly(ethylene oxide-block-alkylene oxide) having a primary and/or secondary and/or

tertiary hydroxyl group, composed of 90% to 10% by weight of ethylene oxide and 10% to 90% by weight of a further alkylene oxide.

5     4.    The polyurethane dispersion of any one of claims 1 to 3, characterized in that the alkylene oxide consists of propylene oxide, butylene oxide, dodecyl oxide, isoamyl oxide, oxetane, substituted oxetanes,  $\alpha$ -pinene oxide, styrene oxide, tetrahydrofuran or further  
10    aliphatic or aromatic alkylene oxides having 4 to 30 carbon atoms per alkylene oxide.

5.    The polyurethane dispersion of any one of claims 1 to 4, characterized in that component (A)(i) consists  
15    of monofunctional polyalkylene glycols and component (B)(i) is an at least functional polyisocyanate.

6.    The polyurethane dispersion of any one of claims 1 to 5, characterized in that component (B)(i) consists  
20    of toluene 2,4-diisocyanate, isomer mixtures of toluene 2,4-diisocyanate and toluene 2,6-diisocyanate, or isomer mixtures of isophorone diisocyanate.

7.    The polyurethane dispersion of any one of claims 1 to 6, characterized in that component (C) consists of  
25    diethanolamine.

8.    The polyurethane dispersion of any one of claims 1 to 7, characterized in that as component (A)(iii)  
30    linear and/or difunctional polyalkylene glycols having a molecular mass of 500 to 5000 daltons are used.

9.    The polyurethane dispersion of any one of claims 1 to 8, characterized in that component (A)(iii) consists  
35    of polypropylene glycols and/or hydrophobically modified block copolymers with ABA, BAB or (AB)<sub>n</sub> structure, A representing a polymer segment having hydrophobizing properties and B a polymer segment based on polypropylene oxide.

10. The polyurethane dispersion of claim 9, characterized in that the polymer segment A is composed of polybutylene oxide, polydodecyl oxide, polyisoamyl  
5 oxide, polyoxetane, substituted polyoxetane, poly- $\alpha$ -pinene oxide, polystyrene oxide, polytetramethylene oxide, further aliphatic or aromatic polyoxyalkylenes having 4 to 30 carbon atoms per alkylene oxide,  $\alpha,\omega$ -polymethacrylatediols,  $\alpha,\omega$ -dihydroxyalkylpolydimethyl-  
10 siloxanes, macromonomers, telecheles or mixtures thereof.

11. The polyurethane dispersion of any one of claims 1 to 10; characterized in that component (A)(v) is a  
15 bishydroxyalkanecarboxylic acid.

12. The polyurethane dispersion of claim 11, characterized in that as bishydroxyalkanecarboxylic acid dimethylolpropionic acid is used.  
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13. The polyurethane dispersion of any one of claims 1 to 12, characterized in that the NCO/OH equivalent ratio in stage a<sub>1</sub>) is set at 1.9 to 2.1 and the NCO/OH+NH equivalent ratio in stage a<sub>2</sub>) is set at 0.95  
25 to 1.05.

14. The polyurethane dispersion of any one of claims 1 to 13, characterized in that the NCO/OH equivalent ratio of components (A)(i), (A)(ii), (A)(iii), (A)(iv),  
30 (A)(v) and (B)(ii) in stage b) is set at a value of 1.25 to 2.5, preferably 1.4 to 2.0.

15. The polyurethane dispersion of any one of claims 1 to 14, characterized in that the neutralizing component  
35 (E) is added in an amount such that the degree of neutralization, based on the free carboxylic acid and/or sulfonic acid groups of the polyurethane prepolymer, is 25 to 100 equivalent%, preferably 50 to 100 equivalent%.

16. The polyurethane dispersion of any one of claims 1 to 15, characterized in that the chain extender component (G) is added in an amount such that the degree of chain extension, based on the free isocyanate groups of the polyurethane prepolymer, is 50 to 100 equivalent%, preferably 70 to 80 equivalent%.

17. The polyurethane dispersion of any one of claims 1 to 16, characterized in that the chain stopper component (H) is added in an amount such that the degree of chain termination, based on the free isocyanate groups of the polyurethane prepolymer, is 0 to 50 equivalent%, preferably 20 to 30 equivalent%.

18. The polyurethane dispersion of any one of claims 1 to 17, characterized in that the amount of ethylene oxide group in the polyurethane polymer formed from components (A), (B), (C), (E), (G) and (H) is 0.5% to 10% by weight, preferably 2% to 5% by weight.

19. The polyurethane dispersion of any one of claims 1 to 18, characterized in that in the polyurethane polymer formed from components (A), (B), (C), (E), (G) and (H) the amount of carboxylate and/or sulfonate groups is set at 5 to 25 meq·(100 g)<sup>-1</sup>, preferably at 10 to 20 meq·(100 g)<sup>-1</sup>, and the acid number at 5 to 30 meq KOH·g<sup>-1</sup>, preferably at 10 to 25 meq KOH·g<sup>-1</sup>.

20. The polyurethane dispersion of any one of claims 1 to 19, characterized in that the solids content of polyurethane polymer composed of components (A), (B), (C), (E), (G) and (H) is set at 30% to 70% by weight, preferably 50% to 55% by weight, based on the total amount of the polyurethane dispersion.

21. The polyurethane dispersion of any one of claims 1 to 20, characterized in that the average particle size of the micelles is 50 to 500 nm, preferably 100 to

400 nm.

22. The polyurethane dispersion of any one of claims 1 to 21, characterized in that the average molar mass (number average) is 25 000 to 500 000 daltons.

23. A process for preparing an electrosterically stabilized polyurethane dispersion of any one of claims 1 to 22, characterized in that

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a) a hydrophilic and solvent-free macromonomer (A)(ii) with monomodal molecular mass distribution, is prepared by

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a<sub>1</sub>) reacting 50 to 100 parts by weight of a hydrophilic alkyl- or arylpolyalkylene glycol (A)(i) with 1 to 100 parts by weight of a polyisocyanate component (B)(i), optionally in the presence of a catalyst, in the absence of solvents, the reaction conditions and the selectivities of components (A)(i) and (B)(i) being chosen such that only one isocyanate group of component (B)(i) reacts with component (A)(i), and subsequently

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a<sub>2</sub>) reacting the uniform preadduct from stage a<sub>1</sub>) completely with 0.5 to 200 parts by weight of a compound (C) in the absence of solvents, the reaction conditions and the selectivity of component (C) being chosen such that only one reactive group of component (C) reacts with the free isocyanate group(s) of the preadduct,

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b) the polyurethane dispersion is prepared by

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b<sub>1</sub>) reacting 2 to 50 parts by weight of the hydrophilic and solvent-free macromonomer (A)(ii) with 25 to 250 parts by weight of the polyisocyanate component (B)(i), optionally in

the presence of 0 to 50 parts by weight of a solvent component (D) and also of a catalyst,

- 5        b<sub>2</sub>) reacting the polyurethane preadduct from stage  
      b<sub>1</sub>) with 50 to 100 parts by weight of a  
      polymeric polyol (A)(iii) and optionally with  
      0.5 to 10 parts by weight of a low molecular  
      mass polyol component (A)(iv), optionally in  
      the presence of a catalyst,
- 10        b<sub>3</sub>) reacting the homogeneous polyurethane preadduct  
      from stage b<sub>2</sub>) with 2 to 20 parts by weight of  
      a polyol component (A)(v), optionally in the  
      presence of a catalyst,
- 15        b<sub>4</sub>) admixing the homogeneous polyurethane  
      prepolymer from stage b<sub>3</sub>), before or during  
      dispersion in 50 to 1500 parts by weight of  
      water, with 2 to 20 parts by weight of a  
20        neutralizing component (E),
- b<sub>5</sub>) dispersing the optionally (partially)  
      neutralized polyurethane prepolymer from stage  
      b<sub>4</sub>) in 50 to 1500 parts by weight of water,  
25        which optionally further contains 0 to 100  
      parts by weight of a formulating component (F),  
      and finally
- b<sub>6</sub>) reacting the (partially) neutralized  
30        polyurethane prepolymer dispersion from stage  
      b<sub>5</sub>) with 3 to 60 parts by weight of a chain  
      extender component (G) and also, subsequently  
      or simultaneously, with 0 to 30 parts by weight  
      of a chain stopper component (H).
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24. The process of claim 23, characterized in that in reaction stage a<sub>1</sub>) component (B)(i) is metered into component (A)(i), or component (A)(i) is metered into component (B)(i).

25. The process of claim 23, characterized in that reaction stages  $a_1$ ) and  $a_2$ ) are carried out at a temperature of 10 to 30°C.

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26. The process of any one of claims 23 to 25, characterized in that reaction stages  $b_1$ ),  $b_2$ ) and  $b_3$ ) are carried out at a temperature of 60 to 120°C, preferably of 80 to 100°C.

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27. The process of any one of claims 23 to 26, characterized in that reaction stages  $b_4$ ) and  $b_5$ ) are carried out at a temperature of 40 to 60°C.

15 28. The process of any one of claims 23 to 27, characterized in that reaction stage  $b_6$ ) is carried out at 30 to 50°C.

20 29. The process of any one of claims 23 to 28, characterized in that following reaction stage  $b_6$ ) any free NCO groups still present are completely chain-extended with water.

25 30. The use of a polyurethane dispersion of any one of claims 1 to 22 as a binder in a liquid or pasty construction product in the form of

(a) synthetic resin plasters,

30 (b) bitumen compounds and asphalt, and

(c) individual components of external insulation and finishing systems, optionally with the addition of mineral binders.

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31. The use of a polyurethane dispersion of any one of claims 1 to 22 as a modifying component for mineral construction products, in the form of

- (a) mortar additive dispersions for screeds, trowel-applied flooring compounds, and leveling components,
- 5 (b) mortar additive dispersions for construction adhesives, tile adhesives and EIFS adhesives,
- (c) dispersions as mortar additives for 2-component grouts,
- 10 (d) mortar additive dispersions for concrete repair systems, and
- (e) polymer dispersions as additives in concrete
- 15 construction work.

32. The use of a polyurethane dispersion of any one of claims 1 to 21 as a binder in formulations - optionally comprising mineral binders - for sport floor coverings and tennis court surfacings, in the form of

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- (a) binders for elastic layers, composed of rubber granules or of fibers with or without adjuvants,
- 25 (b) adhesion promoters or primers for the base surfaces of sport floor coverings,
- (c) spray coatings, with or without texturing fillers, for application to rigid or elastic base surfaces,
- 30 (d) leveling coatings for application to rigid or elastic base surfaces,
- (e) troweling compounds for sealing the pores of rigid
- 35 or elastic base surfaces,
- (f) adhesives for bonding prefabricated elastic layers,

(g) sealer coatings, with or without pigments, and

(h) line paints.

5 33. The use of a polyurethane dispersion of any one of claims 1 to 22 as a binder in formulations - optionally comprising mineral binders - for crack-bridging coating systems, in the form of

10 a) prime, float or top layers, and also spray coatings or sealer coatings on preferably primed surfaces of built structures,

b) (optionally flame-retarded) roof coatings or roof-  
15 painting materials, and

c) (optionally flame-retarded) seals for built structures in opencast or underground mining.

20 34. The use of a polyurethane dispersion of any one of claims 1 to 22 as a binder for producing optionally cement-based, aqueous high-build coatings.

35. The use of a polyurethane dispersion of any one of  
25 claims 1 to 22 as a binder for coatings, sealants, printing inks, paints and varnishes, primers, adhesives, membranes for the surfaces of mineral building materials, such as concrete, gypsum, ceramic, clay, and cement, and also for the surfaces of glass,  
30 rubber, wood and woodbase materials, plastic, metal, paper, and composites.

36. The use of a polyurethane dispersion of any one of claims 1 to 22 as a binder for coating real and  
35 synthetic leathers and also paper and cardboard articles and for producing synthetic leathers.

37. The use of any one of claims 30 to 36, characterized in that the polyurethane dispersion is

used in one-, two- or multi-component form, it being possible for the further components to comprise formulating ingredients and/or hardeners.

- 5 38. The use of any one of claims 30 to 36, characterized in that the polyurethane dispersion is used in combination with formulating ingredients and, optionally, further polymers in the form of redispersible powders.

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39. The use of any one of claims 30 to 36, characterized in that the polyurethane dispersion is used as a binder in amounts of 0.5% to 75% by weight, based on the fully formulated end product.